DEPARTAMENTO DE
MATEMÁTICA APLICADA

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Instituto de Matemática Interdisciplinar

Seminario de Matemática Aplicada

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"Improving the accuracy of heat balance integral methods (HBIMs) applied to thermal and Stefan problems"

This talk concerns the study of conventional and refined heat balance integral methods applied to a variety of phase change problems. These include standard test problems, both with one and two phase changes, which have exact solutions to enable us to test the accuracy of the approximate solutions. We give an overview of the development of this method, originally used for analysing boundary layers. Although this method has made the greatest impact on Stefan problems, where very few exact solutions exist, we begin by considering standard thermal problems to highlight the original method and to explain how we have significantly improved the accuracy of these approximate solutions.

The method involves choosing an approximating function for the temperature, which is usually a polynomial. The most contentious aspect of the HBIM is the choice of power of the highest order term. Our work has developed a method where the exponent is determined during the solution process, and it produces significantly better results than all previous models. We also show that an extra improvement can be made by including a logarithmic term in the approximating function.

Finally, we show how this method can be applied to Stefan problems and briefly discuss the extensions to applications such as the 1D melting of a finite thickness layer, solidification from an incoming fluid, removal of mass from an object by vaporization (known as ablation) and determining travelling wave solutions to the Korteweg-de Vries equation.

Organizado por el Departamento de Matemática Aplicada de la UCM, el Grupo MOMAT y el IMI.

Fecha: Martes 23 de junio, a las 12.00 horas

Seminario de Matemática Aplicada (aula 209)
Facultad de CC Matemáticas, UCM.